TIKHONOV, A.N.

C

USE OF PHOTOSTAMPING TO DECORATE GLASS SHAPES WITH CURVED SURFACES. R. G. Tempel'man and A. N. Tikhonov. Legkaya Prom., 11[4]26-29 (1951).—The methods for copying an image directly and by means of a flexible film, for conical, spherical, and cylindrical shapes are described. A device with mirror strips insures uniform exposure of shape to the light. Illustrated. B. Z. K.

TIKHONOV, A.N.

"Systems of Differential Equations which Contain a Small Parameter in the Derivatives", UMN 7, Nr. 1 (47), 140-142. (1952).

TIKHONOV, A. N.

PA 237T86

USSR/Mathematics - Small Parameter Nov/Dec 52

"Systems of Differential Equations Containing Small Parameters in the Derivatives," A.N. Tikhonov, Moscow

"Matemat Sbor" Vol 31 (73), No 3, pp 575-586

Considers the system x' = f(x,z,t), az'= F(x,z,t), where x,f,z,F are vectors of an n-dimensional space. Studies the solutions of this system for the case where a tends to 0. Cites similar works (1950-51) of I. S. Gradshteyn and A. B. Vasil'yeva.

237T86

TIKHONOV, A. N.

Pattern-Making.

Accurate lay-out patterns are a Russian invention. Vest. mash., 32, No. 3, 1952.

9. Monthly List of Russian Accessions, Library of Congress, October 1952, Uncl.

TIKHONOV A. N.

USSR. 550.371

2935. On the variation of the earth's electric field. A. N. TIKHONOV AND N. V. LIPSKAYA. Dokl. Akad. Nauk SSSR, 87, No. 4, 547-50 (1952) In Russian.

At attempt is made to relate the observed variations in the earth's electric and magnetic field by the use of Maxwell's equations and certain simplifying assumptions. The assumption is made that the earth behaves like a conductor of depth L and conductivity k. The theory is applied to experimental data for three stations and good agreement is obtained for two. L is found to be about 1000 km and k about 0·01 mho/m.

J. H. HOUGH

Translation DRB-T175R. 23 Jun 55

TIKHONOV, A.N.

AID 685 - X

PHASE X TREASURE ISLAND BIBLIOGRAPHICAL REPORT

BOOK

Authors: TIKHONOV, A. N. and SAMARSKIY, A. A.

Full Title: THE EQUATIONS OF MATHEMATICAL PHYSICS. 2-nd ed., rev. and suppl.

Transliterated Title: Uravneniya matematicheskoy fiziki. Izd. 2-e, isprav. i dopol.

PUBLISHING DATA

Originating Agency: None

Publishing House: State Publishing House of Technical and Theoretical Literature

Date: 1953 No. pp.: 679 No. of copies: 25,000

Editorial Staff

Contributors: A. B. Vasil'yeva, V. B. Glasko, V. A. Il'in, A. V. Luk'yanov, O. I. Panych, B. L. Rozhdestvenskiy, A. G. Sveshnikov, D. N. Chetayev and Yu. L. Rabinovich.

PURPOSE AND EVALUATION: Approved by the Main Administration of Higher Education of the Ministry of Culture of the USSR as a textbook for physico-mathematical faculties of state universities. In comparison with Couzant and Hilbert's Methods of Mathematical Physics, this book is suitable only for preliminary study of this subject.

AID 685 - X

Uravneniya matematicheskoy fiziki.
Izd. 2-e, isprav. i dopol.

TEXT DATA

Coverage: In this book only those problems of mathematical physics are considered which can be solved by using partial differential equations. Only part of material pertaining to the methods of mathematical physics is presented. The theory of integral equations and methods of calculus of variation are not included, and approximate methods set out only to a limited extent.

Table of Contents

Uravneniya matematicheskoy fiziki. AID 685 - X
Izd. 2-e, isprav. i dopol.

No. of References: Some footnotes scattered throughout the text
Facilities: None

TIKHONOV, A.N.; SAMARSKIY, A.A.

Magnetization of a magneto-dielectric cylinder with the calculation of magnetic viscosity. Vest.Mosk.un. 8 no.2:43-51 F '53. (MLRA 6:5)

1. Kafedra matematiki. (Electromagnetism)

TIKHONOV, A.N.; ENENSHTEYN, B.S.

Physical causes of errors received in conducting vertical electrical prospecting by the compensation method. Prikl. geofiz. no.10:74-83 '53. (MLRA 8:7)

1. Chlen-korrespondent AN SSSR (for Tikhonov). 2. Nauchnyy sotrudnik Geofizicheskogo instituta AN SSSR (for Enenshteyn).
(Prospecting--Geophysical methods)

4

Mathematical Reviews
Vol. 14 No. 11
Dec. 1953
Analysis

Gradštein, I. S. Application of A. M. Lyapunov's theory of stability to the theory of differential equations with small coefficients in the derivatives. Mat. Sbornik N.S. 32(74), 263–286 (1953). (Russian)

Let all quantities except t and η be finite-dimensional vectors. The author gives sufficient and highly complicated conditions in order that a solution of

$$\frac{dx}{dt}=f(x, y, t, \eta), \quad \eta\frac{dy}{dt}=h(x, y, t, \eta),$$

initiated at $x(0, \eta)$, $y(0, \eta)$ and converging to $x(0)$, $y(0)$ as $t\rightarrow 0$, te to the solution of the system obtained for $\eta=0$, initiated at $x(0)$, $y(0)$. Similar treatment for a system

$$\frac{dx}{dt}=f(x, y, z, t, \eta), \quad \eta\frac{dy}{dt}=g(x, y, z, t, \eta),$$

$$\eta^{1+\alpha}\frac{dz}{dt}=h(x, y, z, t, \eta), \quad \alpha>0.$$

Close connection is established with asymptotic stability à la Lyapunov.

[References: Gradštein, Doklady Akad Nauk SSSR (N.S.) 64, 441–443; 65, 789–792; 66, 789–... (1949); 82, 5–8 (1952); Izvestiya Akad. Nauk. Ser. Mat. 13, 253–280 (1949); these Rev. 10, 536, 708, 709; 13, 557; 10, 709; Tihonov, A. N., Mat. Sbornik N.S. 27(69), 147–156 (1950); these Rev. 12, 181; see also the preceding review.]

S. Lefschetz (Princeton, N. J.).

TIKHONOV, A. N.; ENENSHTEIN, B. S.

Geophysics

Effect of the processes of setting electric currents in the earth for field measurements in electrical soundings, Dokl. AN SSSR 88, No. 5, 1953.

Clarification of the causes of wide divergencies, amounting to several tens of percent, in different field measurements conducted in the same locality, which cannot be due to results of chance errors. Indebted to A.I.Dyukhov and A.M.Zagarmistr. Submitted 4 Dec 52.
258T78

9. Monthly List of Russian Accessions, Library of Congress, May 1953. Unclassified.

TIKHONOV, A.N., IVANOV, A.G., TROITSKAYA, V.A., and D'yakonov, B.V.

"Relationship Between Earth Currents and Earth quakes" Tr. Geofiz. in-ta AN SSSR No 25, 1954, 191-131

A relationship between the propagation of seismic waves and the appearance of an electromagnetic perturbation, the so-called seismoelectric effect is held possible. The effect originates in slow undulations of the terrestrial core which may propagate as an elastic wave. The noticed coincidences of seismic waves and electric perturbations indicate the necessity of recording the slow motions of the terrestrial core. (RZhFiz, No 10, 1955)

APPROVED FOR RELEASE: 07/16/2001 CIA-RDP86-00513R001755610020-4"

LEYBENZON, Leonid Samuilovich, 1879-1951 (deceased); NEKRASOV, A.I., akademik; TIKHONOV, A.N.; IL'YUSHIN, A.A.; SOKOLOVSKIY, V.V.; GALIN, L.A.; SHCHELKACHEV, V.N., doktor tekhnicheskikh nauk; TREBIN, F.A., doktor tekhnicheskikh nauk; GRIGOR'YEV, A.S., kandidat tekhnicheskikh nauk; SEDOV, L.I., akademik, redaktor; ZVOLINSKIY, N.V., professor, redaktor; ALEKSEYEVA, T.V., tekhnicheskiy redaktor.

[Collected works] Sobranie trudov. Moskva, Izd-vo Akademii nauk SSSR. Vol.4[Hydroaerodynamics. Geophysics] Gidroaerodinamika, Geofizika, 1955. 398 p. (MLRA 8:11)

1. Chlen-korrespondent AN SSSR (for Tikhonov, Il'yushin, Sokolovskiy, Galin)

(Geophysics) (Fluid dynamics)

LEYBENZON, Leonid Samuilovich, akademik; NEKRASOV, A.I., akademik; TIKHONOV, A.N.; IL'YUSHIN,A.A.; SOKOLOVSKIY, V.V.; SHCHELKACHEV, V.N.,doktor tekhnicheskikh nauk: TREBIN, F.A., doktor tekhnicheskikh nauk, redaktor; GALIN,L.A.; GRIGOR'YEV, A.S., doktor tekhnicheskikh nauk; CHARNYY, I.A., doktor tekhnicheskikh nauk, redaktor; ALEKSEYEVA, T.V., tekhnicheskiy redaktor.

[Collected works] Sobranie trudov. Moskva, Izd-vo Akademii nauk SSSR. Vol.3.[Petroleum engineering] Neftepromyslovaia mekhanika 1955. 678 p. (MLRA 8:10)

1. Chlen-korrespondent AN SSSR (for Tikhonov, Il'yushin, Sokolovskiy and Galin)
(Petroleum engineering)

USSR/ Physics - Magnetization FD-3156

Card 1/1 Pub. 153 - 12/26

Author : Tikhonov, A. N; Samarskiy, A. A.

Title : Magnetization of a cylinder with winding taking account of magnetic viscosity

Periodical : Zhur. tekh. fiz., 25, No 13 (November), 1955, 2319-2328

Abstract : The authors consider the following problem: a conducting cylinder of infinite length parallel to the z-axis is situated in a constant magnetic field such that at moment $t=0$ within the cylinder there is established a constant magnetic field of strength H_0 directed along the z-axis; at moment $t=0$ the external field is abruptly changed from $H=H_0$ to $H=H_1$, which can be greater or less than H_0, with the possibility $H_1=0$. They note that the solution on the basis of the Maxwell equations was first obtained by B. A. Vvedenskiy (ZhRFKhO, 55, 1, 1923; see also A. N. Tikhonov, Sbornik statey pod red. V. K. Arkad'yeva, Publishing House of Dept. Tech. Sci. of Acad. Sci. USSR, p. 80, 1938). The aim of the authors in the present article is to solve the problem of magnetic reversal of a conducting cylinder in the presence of not only elastic but also viscous magnetization, a similar problem for the case of plane layer having been considered by A. N. Tikhonov, ZhTF, 7, 38, 1937. The authors acknowledge that the works of R. V. Telesnin (ZhETF, 18, No II, 970, 1948; DAN SSSR, 25, No 5, 1950) suggested the present problem.

Submitted : October 29, 1952

Tikhonov, A.N.

TIKHONOV, A.N., prof.; SOKOLOV, A.A., prof., otv.red.

[Program in higher mathematics; for the Physics Faculty] Programma po vysshei matematike (dlia fizicheskogo fakul'teta). 1956. 7 p. (MIRA 11:3)

1. Moscow. Universitet. 2. Chlen-korrespondent AN SSSR (for Tikhonov)
(Mathematics--Study and teaching)

~~TIKHONOV, A.N~~ TIKHONOV A.N

SUBJECT USSR/MATHEMATICS/Differential equations CARD 1/1 PG - 608
AUTHOR BUDAK,B.M., SAMARSKIJ A.A., TICHONOV A.N.
TITLE Collection of problems for mathematical physics.
PERIODICAL Moscow: State publication for technical-theoretical literature
684 p. (1956)
reviewed 2/1957

This collection originates in a textbook of Samarskij and Tichonov (The equations of mathematical physics, Moscow 1953) and a smaller collection of problems of Budak (Collection of problems for mathematical physics, MGU-MMI (1952)). But this material is still extended, especially it is represented in a detailed manner. 130 pages contain problems and questions and 550 pages contain solutions and instructions for solutions. Only boundary value problems for partial differential equations of second order are treated. The knowledge of the general theory is assumed. In three chapters the three types of equations are treated, the chapters are subdivided according to methods to be applied. There follow again three chapters with the same busdivision which treat essentially more difficult questions. An important part of the problem consists in deriving the differential equation and its boundary conditions from the given physical problem. The method of solution is given so detailed that a self-study for students is possible. The book represents a source of wealth for the applied mathematician and for the theoretical physicist.

TIKHONOV, A.N.; SHAKHSUVAROV, D.N.

Method of computing electromagnetic fields excited by an alternating current in schistose media. Izv.AN SSSR Ser.geofiz.no.3:245-251 Mr '56. (MLRA 9:7)

1.Akademiya nauk SSSR, Geofizicheskiy institut.
(Electromagnetism)

TIKHONOV, A.N.; SHAKHSUVAROV, D.N.

Possibility of utilizing the impedance of a natural terrestial electromagnetic field for studying its upper layers. Izv.AN SSSR. Ser.geofiz. no.4:410-418 Ap '56. (MLRA 9:8)

1. Akademiya nauk SSSR, Geofizicheskiy institut.
(Terrestrial electricity)

TIKHONOV, A.N.

SUBJECT USSR/MATHEMATICS/Differential equations CARD 1/1 PG - 426
AUTHOR TICHONOV A.N.
TITLE On difference schemes for equations with discontinuity coefficients.
PERIODICAL Doklady Akad. Nauk 108, 393-396 (1956)
reviewed 12/1956

For the solution of the boundary value problem

$$\frac{d}{dx}\left(k(x)\frac{dy}{dx}\right) = -f(x) \qquad (0<x<1), \quad y(0) = y'(1) = 0$$

the differential equation is replaced by the difference equation

$$(A_i y_{i-1} + C_i y_i + B_i y_{i+1})/h^2 = -f(x_i),$$

where A_i, B_i, C_i are linear homogeneous functions of $k(x_{i-1})$, $k(x_i)$, $k(x_{i+1})$ with constant coefficients. The author investigates the convergence of the solution of the difference boundary value problem to the solution of the given problem in the case that $k(x)$ is piecewise continuous as well as its first (or its first and socond) derivative.

LUKYANOV, A. V., ORLOV, Y. V., TIKHONOV, A. N., TUROVTSEV, V. V. and SHAPIRO, I. S.

"Le Models Optique pour l'interaction avec les noyaux des neutrons d'energie moyenne."

report presented at the Intl. Congress for Nuclear Interactions (Low Energy) and Nuclear Structure (Intl. Union and Applied Physics) Paris, 7-12 July 1958.

Tikhonov, A.N.

49-58-3-7/19

AUTHORS: Tikhonov, A.N. and Skugarevskaya, O.A.

TITLE: On the Interpretation of the Creation of an Electric Field in a Layered Medium (Ob interpretatsii protsessa stanovleniya elektricheskogo polya v sloistykh sredakh)

PERIODICAL: Izvestiya Akademii Nauk SSSR, Seriya Geofizicheskaya, 1958, Nr 3, pp 358-362 (USSR)

ABSTRACT: It is assumed that the field is excited by a direct current dipole on the surface of a layered, semi-infinite medium. Curves are calculated of the spatial distribution of the field for the equatorial and axial positions of the source and the measuring dipoles. The electric field is found to depend on the specific resistance of the medium, the distance from the field source and the time. Graphs are given for examples with two and three layers and an equatorial layout at constant time. The two-layered example has a conductor resting on an insulator and the three-layered has a top layer with four times the resistance of the middle layer and, again, an insulator as the base. The author next gives curves for the variation of field with time. The experimental curves in this type of experiment are usually plotted as apparent specific resistance against either distance between the dipoles or time. To interpret this experimental data, the curve thus

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49-58-3-7/19

On the Interpretation of the Creation of an Electric Field in a Layered Medium.

drawn is replaced by the most appropriate theoretical wave. In the particular case of a layered medium underlain by a semi-infinite expanse of high resistance an asymptotic form of the calculation can be made in order to find the specific resistance, etc. Acknowledgement is made to K.P.Koroleva for her participation in the calculations. There are 8 figures and 8 Russian references.

ASSOCIATION: Academy of Sciences USSR, Institute of Physics of the Earth (Akademiya nauk SSSR, Institut fiziki Zemli)

SUBMITTED: May 28, 1957.

AVAILABLE: Library of Congress.

Card 2/2

AUTHOR: Tikhonov, A.N., Corresponding Member of the Academy of Sciences of the USSR and Samarskiy, A.A. SOV/20-122-2-7/42

TITLE: On the Representation of Linear Functionals in the Class of Discontinuous Functions (O predstavlenii lineynykh funktsionalov v klasse razryvnykh funktsiy)

PERIODICAL: Doklady Akademii nauk SSSR, 1958, Vol 122, Nr 2, pp 188-191 (USSR)

ABSTRACT: Let $Q_o(f)$ be the class of the functions piecewise continuous on (a,b). Let the functional $A[f]$ be defined on $Q_o(f)$ by 1.) $A[f_1 + f_2] = A[f_1] + A[f_2]$ 2.) $|A[f]| \leqslant M \sup|f|$. Put

$$\eta_\xi(x) = \begin{cases} 1 & \text{for } a < x < \xi \\ 0 & \text{for } \xi \leqslant x < b \end{cases}$$

$$\pi_\xi(x) = \begin{cases} 1 & \text{for } x = \xi \\ 0 & \text{for } x \neq \xi \end{cases}$$

furthermore put

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On the Representation of Linear Functionals in the Class of Discontinuous Functions SOV/20-122-2-7/42

$$\alpha(\xi) = A\left[\eta_{\xi}(x)\right] \quad , \quad \sigma(\xi) = A\left[\pi_{\xi}(x)\right]$$

Theorem: $$A[f] = \int_a^b f(x)\,d\bar{\bar{\alpha}}(x) + \sum_{i=1}^{\infty}\Big\{ f_r(\xi_i)\left[\bar{\alpha}_r(\xi_i) - \bar{\alpha}(\xi_i)\right] + f_1(\xi_i)\left[\bar{\alpha}(\xi_i) - \bar{\alpha}_1(\xi_i)\right]\Big\} + \sum_{j=1}^{\infty} \sigma(\zeta_j) f(\zeta_j)$$

Here $\bar{\alpha}(\xi) = \alpha(\xi) - \sum_{\zeta_j < \xi} \sigma(\zeta_j)$, $\bar{\bar{\alpha}}(\xi)$ the continuous part of $\bar{\alpha}(\xi)$, i.e.

$$\bar{\bar{\alpha}}(\xi) = \bar{\alpha}(\xi) - \sum_{\xi_i < \xi}\left[\bar{\alpha}_r(\xi_i) - \bar{\alpha}_1(\xi_i)\right]$$

furthermore $\bar{\alpha}_r(\xi) = \bar{\alpha}(\xi + 0)$, $\bar{\alpha}_1(\xi) = \bar{\alpha}(\xi - 0)$, there being at most a countable set of points at which $\sigma(\xi) \neq 0$.

Three further theorems deal with the difference of two linear

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On the Representation of Linear Functionals in the Class of Discontinuous Functions SOV/20-122-2-7/42

functionals, give conditions that from $f \geqslant 0$ it follows $A[f] \geqslant 0$ and conditions for $B[f(x)] = A[f(-x)]$.

SUBMITTED: April 20, 1958

Card 3/3

AUTHORS: Tikhonov, A.N., Corresponding Member, Academy of Sciences, USSR, and Samarskiy, A.A. SOV/20-122-4-6/57

TITLE: On Homogeneous Difference Schemes (Ob odnorodnykh raznostnykh skhemakh)

PERIODICAL: Doklady Akademii nauk, SSSR, 1958, Vol 122, Nr 4, pp 562-565 (USSR)

ABSTRACT: The paper is a continuation of the formerly published investigation [Ref 1] of the authors. They propose several schemes of differences which are suitable for a solution as uniform as possible of different differential equations. There are 2 Soviet references.

SUBMITTED: June 20, 1958

Card 1/1

APPROVED FOR RELEASE: 07/16/2001 CIA-RDP86-00513R001755610020-4"

BEREZIN, Ivan Semenovich; ZHIDKOV, Nikolay Petrovich; TIKHONOV, A.N., prof., retsenzent; BUDAK, B.M., dotsent, retsenzent; red.; GORBUNOV, A.D., red.; MURASHOVA, N.Ya., tekhn.red.

[Methods of calculations] Metody vychislenii. Moskva, Gos.izd-vo fiziko-matem.lit-ry. Vol.1. 1959. 464 p. Vol.2. 1959. 619 p. (MIRA 13:5)

1. Chlen-korrespondent Akademii nauk SSSR (for Tikhonov).
(Electronic calculating machines) (Numerical calculation)

SOV/49-59-1-6/23

AUTHORS: Tikhonov, A. N. and Sveshnikov, A. G.

TITLE: On the Slow Motion of a Conducting Medium in a Stationary Magnetic Field (O medlennom dvizhenii provodyashchey sredy v statsionarnom magnitnom pole)

PERIODICAL: Izvestiya Akademii Nauk SSSR, Seriya Geofizicheskaya, 1959, Nr 1, pp 49-58 (USSR)

ABSTRACT: In certain geophysical problems, such as determination of the speed of ocean currents and in cosmic electrodynamics, it is necessary to allow for the effects produced by the motion of a conducting medium in a stationary magnetic field. Several workers (Refs 1-3) dealt with determination of the electric field induced in ocean currents by the constant magnetic field of the Earth. These workers did not allow for the finite conductivity of the ocean floor and the width of the currents. The present paper is a theoretical discussion of the same problem of motion of ocean currents in the Earth's magnetic field but with allowance for the effects mentioned above.
If the medium (seawater) is uniform (electrical conductivity σ = const.) and moves with a constant

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On the Slow Motion of a Conducting Medium in a Stationary Magnetic Field

velocity (ϑ_o = const.) in a constant magnetic field (H_o = const.), then the induced electric field E (only the horizontal x-component is not equal to zero) is given by

$$E_x = -\frac{\vartheta_o}{c} H_z^o \tag{13}$$

where c is velocity of sound and

H_z^o is the vertical component of the Earth's magnetic field.

If H_z^o = 0.2 gauss and seawater moves at 10 km/hr, the induced electric field is of the order of 6×10^{-7} V/cm. Eq.(13) may also be used to find the speed of an ocean current ϑ_o from known values of H_z^o and E_x. This simple formula is, however, only a first approximation and more complicated expressions are derived by the author. These expressions allow for the finite conductivity of the ocean floor and for the width of

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On the Slow Motion of a Conducting Medium in a Stationary Magnetic Field

the flowing current.

Acknowledgments are made to V. V. Novish for his advice.

There are one figure and 6 references, 3 of which are Soviet, 3 English.

ASSOCIATION: Moskovskiy gosudarstvennyy universitet im. M. V. Lomonosova (Moscow State University imeni M. V. Lomonosov)

SUBMITTED: December 10, 1957

Card 3/3

67506

~~16(1)~~ 16.4100 SOV/155-59-1-9/30

AUTHORS: Tikhonov, A.N., and Samarskiy, A.A.

TITLE: On the Development With Respect to a Parameter of Integrals the Kernel of Which is of the Type of the δ -Function

PERIODICAL: Nauchnyye doklady vysshey shkoly. Fiziko-matematicheskiye nauki, 1959, Nr 1, pp 54 - 61 (USSR)

ABSTRACT: The authors consider integrals

$$(1) \quad J\left[h, x_0 f\right] = \int_a^b \phi(x-x_0, h) f(x) dx \qquad (a < x_0 < b)$$

where

$$(2) \quad \varphi(x-x_0, h) = \frac{1}{h}\,\omega\left(\frac{x-x_0}{h}\right).$$

Let $|f(x)| < M$, $a < x < b$, and continuous in $x = x_0$ $(a < x_0 < b)$. Let the function $\omega(\xi)$ be absolutely integrable and for $\xi \to \pm\infty$ let it have the development

$$\omega(\xi) = \frac{q_2}{\xi^2} + \frac{q_3}{\xi^3} + \dots + \frac{q_k}{\xi^k} + \omega_k(\xi), \quad \lim_{\xi \to \infty} \xi^k \omega_k(\xi) = 0$$

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q

On the Development With Respect to a Parameter SOV/155-59-1-9/30
of Integrals the Kernel of Which is of the Type of the δ-Function

Let the function $f(x)$ have a differential of the order $k+1$ in x_o. Under these assumptions there holds the asymptotic development

$$(4) \quad J = J_o + hJ_1 + h^2 J_2 + \dots + h^n J_n + h^n \varsigma(h) ,$$

where $\varsigma(h) \to 0$ with $h \to 0$. Here

$$I_k = a_k \frac{f^{(k)}(x_o)}{k!} + q_{k+1} \int_a^b \frac{f_{k-1}(x)dx}{(x-x_o)^{k+1}} - $$

$$- q_{k+1} \sum_{s=0}^{k-1} \frac{f^{(s)}(x_o)}{s!(k-s)} \left[\frac{1}{(b-x_o)^{k-s}} - \frac{1}{(a-x_o)^{k-s}} \right]$$

where $f_k(x)$ is the remainder term of the Taylor development

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On the Development With Respect to a Parameter of Integrals the Kernel of Which is of the Type of the δ-Function SOV/155-59-1-9/30

of $f(x)$ at the point $x = x_0$ and $a_k = \int_{-\infty}^{\infty} \xi^k \omega_k(\xi) d\xi$ (the integrals are understood in the sense of the principal value at the point $x = x_0$ or $\xi = \pm \infty$).

The proposed method can be extended to the case of several variables.

ASSOCIATION: Moskovskiy gosudarstvennyy universitet imeni M.V.Lomonosova (Moscow State University imeni M.V. Lomonosov)

SUBMITTED: January 7, 1959

Card 3/3

67507

SOV/155-59-1-10/30

~~16(1)~~ 16.4100

AUTHORS: Tikhonov, A.N., and Samarskiy, A.A.

PERIODICAL: Nauchnyye doklady vysshey shkoly. Fiziko-matematicheskiye nauki, 1959, Nr 1, pp 62 - 70 (USSR)

TITLE: On the Asymptotic Development of Integrals With a Slowly Decreasing Kernel

ABSTRACT: The authors investigate the asymptotics of the integral

$$(1)\quad J\left[h,x_0\,;\,f\right] = \frac{1}{h}\int_a^b \omega\left(\frac{x-x_0}{h}\right) f(x)dx$$

for $h\to 0$ if the function $\omega(\xi)$ has the form

$$(4')\quad \omega(\xi) = \sum_{k=1}^{n}\left(\frac{q_k}{\xi^k} + \frac{q_k}{\xi^{k-1}|\xi|}\right) + \omega_n(\xi)\ ,\quad \omega_n(\xi)=0\left(\frac{1}{\xi^{n+1}}\right)\ \text{for}\ \xi\to\pm\infty$$

It is shown that under the assumption that $|f(x)| < M$ on (a,b) and $f(x)$ in $x_0 (a < x_0 < b)$ has a differential of $(n+1)^{st}$ order, while $\omega(\xi)$ is absolutely integrable, there

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On the Asymptotic Development of Integrals With a Slowly Decreasing Kernel SOV/155-59-1-10/30

holds the asymptotic development

$$J = \sum_{s=0}^{n} (\hat{J}_s \ln h + J_s) h^s + h^n \xi(h)$$

$(\xi(h) \to 0$ for $h \to 0)$, where

$\hat{J}_s = -(q^+_{s+1} - q^-_{s+1}) \cdot \frac{f^{(s)}(x_0)}{s!}$ and J_s can be represented by a certain combination of sums and integrals.
There is 1 Soviet reference.

ASSOCIATION: Moskovskiy gosudarstvennyy universitet imeni M.V.Lomonosova (Moscow State University imeni M.V. Lomonosov)

SUBMITTED: January 14, 1959

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SOV/49-59-6-2/21

AUTHORS: Tikhonov, A. N., Skugarevskaya, O. A.

TITLE: Asymptotic Behaviour of Formation of the Electromagnetic Field.

PERIODICAL: Izvestiya Akademii nauk SSSR, Seriya geofizicheskaya, 1959, Nr 6, pp 804-814 (USSR)

ABSTRACT: The formation of an electromagnetic field in the ground at greater distances from an underground dipole is described. The components of the electric field on the axis x are denoted as $E_x(x, y, z, t)$ while the vertical components of the magnetic field are denoted as $H_x(x, y, z, t)$. The receiving dipole is placed at the distance $\rho = \sqrt{x^2 + y^2}$ (Fig 1). In order to obtain the asymptotic expression of the field, the Bessel function, Eq (1), and the expressions (2) and (3) are introduced. Thus the formulae (4) to (6) are obtained. It should be noted that $X_0(z, t) = 0$ (Eqs 7-9). Therefore, the terms in Eqs (4), (5) and (6) containing $X_0(0, t)$ are excluded. As an example, a

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homogeneous layer of the thickness l and of the conductivity $\sigma = \sigma_1$, placed on a non-conductive base (Fig 2) is considered. The conditions describing $X_1(z, t)$ are:

$$\frac{\partial^2 X_1}{\partial z^2} = \frac{1}{a^2} \frac{\partial X_1}{\partial t} ;$$

$$\frac{\partial X_1}{\partial z} = -2 \ (z = 0); \quad \frac{\partial X_1}{\partial z} = 0 \ (z = l);$$

$$X_1(z, 0) = 0 \quad (t = 0) .$$

The function $X_1(z, t)$ at $t \to \infty$ cannot converge to $X_1(z, \infty)$ due to $z = 0$ (direct current), i.e. it would increase together with an increase of t. Therefore it cannot be shown that:

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$$X_1(z, t) = Ct + \overline{X}_1(z, t)$$

$$\overline{X}_1(z, t) = X_1^{(o)}(z) + \overline{\overline{X}}_1(z, t),$$

$$\lim_{t \to \infty} \overline{\overline{\overline{X}}}_1(z, t) = 0 ,$$

where $\overline{\overline{\overline{X}}}_1(z, t)$ represent the limiting values, described by Eqs (10) to (19). Figs 3 and 4 illustrate the curves characterizing the formation of the electric field, for the case of equatorial and axial distribution of electrodes, respectively. The axis y represents the logarithms of $\overline{E}|_{\rho=y}$ and $\overline{E}|_{\rho=x}$ while the axis x represents the

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logarithm of τ (top of p 812). The values of

$$\frac{I\,dx}{2\pi\sigma_1\rho^3} \quad \text{and} \quad \frac{I\,dx}{\pi\sigma_1\rho^3}$$

are equivalent to the stationary components E_x. The curves were plotted for various $L = \rho/\ell$ according to Ref 4. The dotted curves were calculated from the formulae of this work. Fig 5 shows the curve calculated from Eqs (17) to (19) for the following data: $\ell = 1/20$ of the distance between the electrodes, $\sigma_1 = 0.1$. The asymptote intersects the axis $\log \rho_k = 0$ at the point ξ, for which $\log t_o$ was calculated from Eq (20), where:

$$S = 10^3 \sqrt{\frac{t_o}{0.314}}$$

 The conductivity σ_1 was determined from:

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$$\sigma_1 = \frac{2t_o}{3(\rho_k t_o - t)} .$$

Thus the segment ABC of the curve is described in terms of $S = \sigma_1 \ell$ for the large $L = \rho/\ell$. Acknowledgments are made to K. P. Korolev for his work on the calculations. There are 5 figures and 15 references, of which 12 are Soviet and 3 are English.

ASSOCIATION: Akademiya nauk SSSR, Institut fiziki Zemli (Academy of Sciences USSR, Institute of Physics of the Earth)

SUBMITTED: April 15, 1958.

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SOV/49-59-7-1/22

AUTHORS: Tikhonov, ~~A. N.~~ and Skugarevskaya, O. A.

TITLE: On the Asymptotic Behaviour of Formation of the Electro-Magnetic Field in Stratified Media

PERIODICAL: Izvestiya Akademii nauk SSSR, Seriya geofizicheskaya, 1959, Nr 7, pp 937-945 (USSR)

ABSTRACT: This is a continuation of the work published in this journal, 1959, Nr 6 (Ref 1). The assumption is made that the source of disturbances is represented by a dipole dx long, placed in the origin of the coordinates xyz (Fig 1). Then the asymptotic formula of the electric field $E_x(x, y, z, t)$ and the vertical components of the magnetic field $H_z(x, y, z, t)$ are defined as Eqs (1)-(3) (Ref 1). The problem of the formation of the asymptotic field can be solved when the limiting conditions of X_n and Z_n are defined. This can be done when the main terms of Eqs (1)-(3) are calculated in respect to ρ, i.e. the functions X_2 and Z_o and the function X_1 are determined. The former are expressed as in Ref 1, the latter can be written as:

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$$X_1(z, t) = Ct + \overline{X}_1(z) + \overline{\overline{X}}_1(z, t) ,$$

where the functions $\overline{X}_1(z)$ and $\overline{\overline{X}}_1(z, t)$ are defined by Eqs (4) to (6). The function $\overline{X}_1(x)$ within the limits z and τ, which are equivalent to 0 and z, can be defined as Eqs (7) to (9). Since the function $\overline{\overline{X}}_1(z, t)$ for large t with the accuracy of e^{-kt} is disregarded, then the expression for $X_1(z, t)$ will take the form as stated at the top of p 940. The conditions of the function $X_2(z,t)$ can be described as Eqs (10) to (14). The function $Z_o(z,t)$ can be derived from the relation $Z_o(z,t) \approx R(z)t + \overline{Z}(z)$ where $R(z)$ and $\overline{Z}(z)$ are limited by the conditions Eqs (15)

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and (16), where the value of R is related to the earth's stratification (Fig 2), as shown in Eq (17). The function $Z_0(0, t)$ in Eqs (1) and (2) will be determined when its derivate is found. This can be done when the term $\bar{Z}'(\gamma) = \beta$ is introduced in Eq (16). Thus, Eqs (18) to (21) are obtained. Finally, when the derivate

$$\frac{\partial X_2}{\partial t}(0, t) = 2Nt + M(0)$$

is determined and substituted into the expressions for

$$\frac{dR}{dz}, \frac{d\bar{Z}}{dz}, N, M(0), \bar{X}_2(0)$$

in Eqs (1) to (3), the components $\bar{E}_x$ and $\bar{H}_z$ will be found as shown in the lower part on p 944. Thus, the components of the electromagnetic field of the stratified

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medium are determined in terms of a total conductivity S and by the supplementary characteristics of the medium

$$E_0^{ekv}, \quad E_0^{os}, \quad H_1 .$$

The latter can be found experimentally in the same way as S and σ_1 were obtained. The case of a 2-layer cross-section described by σ_1, σ_2, h_1 and h_2 placed on an insulator will be published later. There are 2 figures and 1 Soviet reference.

ASSOCIATION: Akademiya nauk SSSR, Institut fiziki Zemli (Academy of Sciences, USSR, Institute of Physics of the Earth)

SUBMITTED: April 15, 1958.

Card 4/4

SOV/49-59-7-2/22

AUTHORS: Tikhonov, A. N., Shakhsuvarov, D. N.

TITLE: The Electromagnetic Field in a Distant Zone of a Dipole

PERIODICAL: Izvestiya Akademii nauk SSSR, Seriya geofizicheskaya, 1959, Nr 7, pp 946-955 (USSR)

ABSTRACT: The asymptotic field generated by a dipole in a stratified medium is described. A graph of the electric component $\check{E}_x$ calculated according to Ref 1 for the 2-layer geological cross-section is illustrated in Fig 1. Fig 2 represents a similar graph for a 4-layer cross-section with an application of a non-conductive screening. The magnetic field B_z in the 1-layer medium placed on an insulator is illustrated in Fig 3. The vertical component of B_z and the electric component E_x are defined by Eq (1), where the function $Z(\lambda, z)$ for the layer $z_1 \leqslant z \leqslant 0$ is found from Eqs (2) to (6) and the limiting conditions of $Z_m(z)$ are given by Eq (7). The value of B_z calculated from Eq (5) can be expressed as:

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$$\tilde{r}^2\tilde{B}_z = \tilde{B}_o + \frac{1}{\tilde{r}^2}\tilde{B}_2 + \frac{1}{\tilde{r}^4}\tilde{B}_4 + \dots ,$$

In a particular case of the homogeneous layer $[\gamma(z) = \text{const}]$, the separation coefficients of the function $Z(\gamma, 0)$ can be defined as Z_1 and Z_2 (top of p 950) and the function $f(\lambda, z)$ can be found from Eqs (8) to (13) which are substituted into Eq (1). Thus the general formulae (14) are obtained, which, in the 1-layer case, becomes Eq (15) (Fig 4). The vertical component of the field $\tilde{B}_z$ of low frequency for the layer conductivity $\gamma = \gamma(z)$ can be considered as a function $\tilde{B}_z$ $(z = 0, \omega)$ for small values of ω. Then the function $Z_1(z, \omega)$ can be defined from Eqs(16) to (21). Similarly, the function $Z_2(z, \omega)$ can be defined

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from Eqs (22) to (28) and then $\tilde{B}_z$ is determined as

$$\tilde{B}_z = \frac{6}{k^2 r^2}\left[\frac{2}{k^2 z_1^2} + \frac{1}{3}\right]$$

If the layer is of an ideal conductivity ($\gamma_2 = \infty$) , then instead of the limiting conditions (7), those expressed in Eq (29) should be considered. Thus, the functions (30) and (31) are defined. The relationship of the amplitude of the asymptotic value of E_x^{ac} and the magnitude of h_2/Λ is illustrated in Fig 4, curve (6). As a result of these calculations, a method of interpolation can be devised, when difficulties occur in measuring the field, due to limitations of the apparatus. In this case, the formula on p 955 can be applied where B_z^* and $\bar{B}_2^*$ are the real and interpolated values of B_z^* . There are 4 figures and 2 Soviet references.

ASSOCIATION: Akademiya nauk SSSR, Institut fiziki Zemli (Academy of Sciences, USSR, Institute of Physics of the Earth)

SUBMITTED: December 29, 1958.

SOV/49-59-8-14/27

AUTHORS: Tikhonov, A.N., Shakhsuvarov, D. N. and Rybakova, Ye.V.

TITLE: An Attempt to Distinguish the Equivalent Layers by Means of an Alternating Electric Field

PERIODICAL: Izvestiya Akademii nauk SSSR, Seriya geofizicheskaya, 1959, Nr 8, pp 1202-1205 (USSR)

ABSTRACT: The known method of a vertical electric sounding by means of direct current cannot be applied for determining, for example, a two-layer cross-section for

$$S = \frac{h_1}{\rho_1} + \frac{h_2}{\rho_2} = \text{const}$$

as illustrated in Fig 1. However, a method can be considered when $u_i = \rho_i/\rho_1$ (ρ_i - specific resistance) and an alternating current is applied. Fig 2 illustrates the ρ_k curves 1 and 2 of the equivalent cross-section, where the curve 3 representing DC is also included. The frequencies for both curves are shown in Fig 3 and the phase of the electric field E_x for the layers 1 and 2 is shown in Fig 4 ($r = 11$ km). The phase of sounding

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frequency for different distances is shown in Fig 5, while Fig 6 gives the amplitude $\bar{B}_z$ (r = 11 km) and Fig 7 shows the magnetic component $\vartheta \bar{B}_z$ (r = 11 km). These curves indicate that a displacement of the electromagnetic field can be applied for the determination of layers equivalent to the DC method. The method described can also be used in a multi-layered cross-section.

There are 7 figures and 5 Soviet references.

ASSOCIATION: Akademiya nauk SSSR Institut fiziki Zemli (Institute of Physics of the Earth, Ac.Sc., USSR)

SUBMITTED: December 29, 1958

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SOV/49-59-9-13/25

AUTHORS: Tikhonov, A.N. and Dmitriyev, V.I

TITLE: On the Problem of Interference Effect in the Inductive Method of the Aero-electrosurvey

PERIODICAL: Izvestiya Akademii nauk SSSR, Seriya geofizicheskaya, 1959, Nr 9, pp 1393-1395 (USSR)

ABSTRACT: A method is discussed where an emitter, in the form of a horizontal frame is placed on the aircraft flying parallel to the ground surface. A canister, hanging below the aircraft, contains a receiver and this arrangement permits the measuring of the vertical magnetic field. The error of the measurement, due to the vibrations of the canister, which causes the interference, can be determined from the vertical component of magnetic field, Eqs (1) and (2) where r, z, - cylindrical coordinates, k - waving no = 0 in air, I - current of the frame, S frame surface, L - angle between the vertical and the frame, h - height. The first term of Eq (2) represents the initial field H_z^0, related to R and α as illustrated in Fig 1. The second term of Eq (2) represents the reflected field H_z^1 which depends on R, h, α and k. The latter being complex, is

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substituted by the characteristic length $\Lambda = 2\pi/Rek$. The relation of the active ReH_z^1 and reactive JmH_z^1 parts of the reflected field to α Λ at $R = 100$ m and $h = 150$ m, is shown in Figs 3 and 4 respectively. The useful signal P can be defined as Eq (3) where $\Lambda_o = 1000$ m - wave length. The relationship between P and R, h and α, is represented in Fig 5. The magnitude of the interference f for the canister vibrations $\pm 2^o$ can be defined as Eq (4). Its relationship to R, h, and α is illustrated in Fig 6. The relationship between the useful signal and the interference can be obtained from Eq (5) where $f_o =$ 0.01 - constant interference of the apparatus. The relation of S to R, h and α is shown in Fig 7, from which it can be seen that the magnitude of S increases when the value of (h - R) decreases. There are 7 figures.

ASSOCIATION: Akademiya nauk SSSR. Institut fiziki Zemli. (AS USSR. Institute of Physics of the Earth)

SUBMITTED: October 10, 1958

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SOV/49-59-10-7/19

AUTHORS: Tikhonov, A. N., and Dmitriyev, V.I.

TITLE: On a Possibility of Applying the Inductive Method of Aero-Electric Survey for Geological Mapping

PERIODICAL: Izvestiya Akademii nauk SSSR, Seriya geofizicheskaya 1959, Nr 10, pp 1481-1485 (USSR)

ABSTRACT: This is a continuation of the authors' work on this subject published in this journal, Nr 9, 1959, where they have shown that the vertical component of magnetic field can be measured under interference conditions. An attempt is made in the present work to determine the geological characteristics of deposits by means of a vertical component of the magnetic field in a limited range of frequencies. The Earth is assumed to be a two-layered medium, i.e. a homogeneous half-space with resistance ρ_2 is overlaid by a stratum of deposits of thickness ℓ and resistance ρ_1. The corresponding wave numbers (Fig 1) are $k_0 = \omega/c$ - in air, $k_1 = (1 - i)\ 2\pi/\lambda_1$ - in deposits and $k_2 = (1 - i)\ 2\pi/\lambda_2$ - in bottom layer (λ - wavelength). Two cases can be distinguished: (A) The layer of deposits has a resistance much smaller than that of the

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substrate, i.e. the layer of the thickness ℓ lies on a non-conducting base. The vertical component of the magnetic field Im H_z at a height h is defined by the formulae at the bottom of p 1481. This case is illustrated in Figs 2 to 4. (B) The layer of deposits is thin in comparison with the wavelength and it is placed on a homogeneous conducting half-space. In this case deposits are substituted in calculations by an effective resistance $\rho = \rho_1/\ell$. The vertical magnetic component is defined by the formula shown at the bottom of p 1483. This case is illustrated in Figs 5 to 8. There are 8 figures and 2 Soviet references.

ASSOCIATION: Akademiya nauk SSSR. Institut fiziki Zemli (Academy of Sciences USSR. Institute of Physics of the Earth)

SUBMITTED: December 30, 1958

Card 2/2

SOV/49-59-10-3/19

AUTHORS: Tikhonov, A. N., Shakhsuvarov, D. N., and Rybakova, Ye. V.

TITLE: On the Resolving Power of Electromagnetic Sounding in the Presence of Intermediate Non-conductive Layers

PERIODICAL: Izvestiya Akademii nauk SSSR, Seriya geofizicheskaya 1959, Nr 10, pp 1455-1459 (USSR)

ABSTRACT: In the case of alternating electromagnetic fields the presence of a non-conductive layer does not act as a barrier and therefore such fields permit in principle investigation of screened formations. Only a certain range of frequencies can be considered in this case, i.e. the amplitude and phase characteristics of the magnetic and electric components should be determined according to their properties. This can be explained by Fig 1, where curve 1 is calculated for a four-layer cross section with the following parameters: $h_2 = h_1/64$

$h_3 = h_1$, $h_4 = \infty$; $\rho_2 = \infty$, $\rho_3 = \rho_1$, $\rho_4 = \infty$.

This curve is similar to that for a two-layer cross-section, but the thickness of the second layer is equal to that of the top one: $h_1 = h_2 = h_3$,

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$h_4 = \infty$; $\rho_2 = \infty$, $\rho_3 = \rho_1$, $\rho_4 = \infty$. Curve 3 corresponds to a layer of the thickness h_1 placed on an insulator. In all these three cases $r/h_1 = 8$ (r - distance between receiving and transmitting dipoles). It can be seen that a suitable range of frequencies should be chosen so that $-0.1 < \lg \lambda_1/r < 0.3$ (λ_1 - wavelength in top layer). If, for instance, $\rho_1 = 10$ ohms and r = 10 km, then this range will be $0.2h < f < 1h$. This is illustrated in Fig 2 which gives the phase-frequency curves corresponding to Fig 1. Fig 3 shows the amplitudes in relation to the distance r for a given frequency, where the curves 1 and 2 correspond to Fig 1, and the curve 3 - three-layer cross section with $h_2 = h_1/64$, $h_3 = \infty$; $\rho_2 = \infty$, $\rho_3 = \rho_1$.

Card 2/3 The frequency curves of the amplitude $\tilde{E}_x$ are illustrated

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in Figs 4 and 5. There are 8 figures and 1 Soviet reference.

ASSOCIATION: Akademiya nauk SSSR. Institut fiziki Zemli (Academy of Sciences USSR. Institute of Physics of the Earth)

SUBMITTED: December 29, 1958

Card 3/3

AUTHORS: Tikhonov, A. N., Shakhsuvarov, D. N., and Rybakova, Ye. V. SOV/49-59-11-16/28

TITLE: On the Properties of an Electromagnetic Field Generated by the Dipole in a Layer on an Insulator

PERIODICAL: Izvestiya Akademii nauk, SSSR, Seriya geofizicheskaya, 1959, Nr 11, pp 1670-1672 (USSR)

ABSTRACT: The vertical components Bz of the magnetic field are considered in relation to the electric field generated by a dipole . The amplitude curves derived from Eq (1) are shown in Fig 1 where $|B_z|$ - non-dimensional amplitude, μ - magnetic permeability, I - current, r - distance between electrodes, λ - wave-length in top layer, h - thickness of layer. The analysis of data can be done on squared paper, then the magnitude $\bar{B}$, i.e. the vertical displacement, can be calculated from Eq (2). The magnitude of horizontal displacement Δ can be expressed as Eq (3), where $S = \mu h$ - effective conductivity. The magnitude of S can be determined from Eq (7) (Fig 2). The thickness h can be found from Eq (10) (Fig 3). The phase curve is shown in Fig 4, for which the thickness h can be

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determined for the conductivity calculated from E_q (3). Thus the parameters of a layer can be defined from both the amplitudinal and phase curves. There are 4 figures and 2 Soviet references.

ASSOCIATION: Akademiya nauk SSSR, Institut fiziki Zemli (Academy of Sciences USSR, Institute of Physics of Earth)

SUBMITTED: December 19, 1958

Card 2/2

16(1) SOV/20-124-3-9/67

AUTHORS: ~~Tikhonov, A.N.~~ Corresponding Member, Academy of Sciences, USSR and Samarskiy, A.A.

TITLE: On the Convergence of Difference Schemes in the Class of Discontinuous Coefficients (O skhodimosti raznostnykh skhem v klasse razryvnykh koeffitsiyentov)

PERIODICAL: Doklady Akademii nauk SSSR, 1959, Vol 124, Nr 3, pp 529-532 (USSR)

ABSTRACT: The authors consider so-called conservative and quasi-conservative difference schemes for the equation

$$Lu \equiv \frac{d}{dx}\left[\frac{1}{p(x)}\frac{du}{dx}\right] = -f(x)\ ,\quad 0<x<1\ ,\ 0<m\leq p(x)\leq M\ ,$$

where p(x) possesses points of discontinuity. Rather complicated necessary conditions of convergence are given. The general type of the difference schemes satisfying these conditions is determined. Altogether there are given 2 theorems and 3 lemmata.

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On the Convergence of Difference Schemes in the Class of Discontinuous Coefficients

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There are 4 Soviet references.

ASSOCIATION: Matemati heskiy institut imeni V.A. Steklova AN SSSR (Mathematical Institute imeni V.A. Steklov AS USSR)

SUBMITTED: October 13, 1958

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16(1)

AUTHORS: Tikhonov, A.N (Corresponding Member, AS USSR) and Samarskiy, A.A. SOV/20-124-4-13/67

TITLE: One of the best Homogeneous Difference Schemes (Ob odnoy nailuchshey odnorodnoy raznostnoy skheme)

PERIODICAL: Doklady Akademii nauk, 1959, Vol 124, Nr 4, pp 779-782 (USSR)

ABSTRACT: The present paper is a continuation of [Ref 1]. In [Ref 1] the conditions of convergence of the difference scheme $_h^{(p)}$ are given which is used for the solution of

$$\frac{d}{dx}\frac{1}{p(x)}\frac{du}{dx} = - f(x) .$$

In the present paper the authors investigate which of these schemes have a second integral order of exactness. It is shown that there exists only one such "best" scheme; for f(x) 0 it is the scheme:

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One of the Best Homogeneous Differences Schemes SOV/20-124-4-13/67

$$ {}_{h}^{(p)} y_i = \frac{1}{h^2}\left[\frac{y_{i+1} - y_i}{A_{i+1}} - \frac{y_i - y_{i-1}}{A_i} \right], \quad A_i = \int_{1}^{0} p(x_i + sh)\,ds = \frac{1}{h} \int_{x_{i-1}}^{i} p(x)\,dx. $$

A similar uniquely "best" scheme exists for f(x) 0.
Ther are 4 Soviet references.

SUBMITTED: October 13, 1958

1. Chlen-Korrespondent AN SSSR (for Tikhonov)

Card 2/2

16(1)

AUTHOR: Tikhonov, A.N., Corresponding Member, AS USSR — 20-125-5-7/61

TITLE: On the Asymptotic Behavior of Integrals Containing Bessel Functions (Ob asimptoticheskom povedenii integralov, soderzhashchikh besselevy funktsii)

PERIODICAL: Doklady Akademii nauk SSSR, 1959, Vol 125, Nr 5, pp 982-985 (USSR)

ABSTRACT: The author investigates the asymptotic behavior of $I(\varrho) = \int\limits_0^\infty J_0(\lambda\varrho)F(\lambda)d\lambda$ for $\varrho\to\infty$.

Theorem 1: Let the function $F(\lambda)$ and its n first derivatives be of bounded variation on $[0,\infty)$; let $F^{(2k)}(0) = 0$ for $k=0,1,\ldots,m$, where $m = \left[\frac{n-1}{2}\right]$; let $F^{(n)}(\lambda)$ be bounded, the other derivatives be continuous. Then

$$I(\varrho) = \frac{1}{\varrho^n}\varepsilon(\varrho),$$

where $\varepsilon(\varrho)\to 0$ for $\varrho\to\infty$.

Theorem 2: Let the assumptions of the first theorem be

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satisfied with the exception of $F^{(2k)}(0) = 0$. Then

$$I(\varrho) = \frac{F(0)}{\varrho} + C_2 \frac{F''(0)}{\varrho^2} + \ldots + C_{2m} \frac{F^{(2m)}(0)}{\varrho^{2m+1}} + \frac{1}{\varrho^n} \varepsilon(\varrho),$$

where $m = \left[\frac{n-1}{2}\right]$, $C_0 = 1$, $C_{2k} = (-1)^k \frac{1\cdot 3\cdots(2k-1)}{2^k \cdot k!}$.

Theorem 3: Let $F(\lambda)$ satisfy the assumptions of theorem 2. Let the function $F_{(1)}(\lambda) = \lambda[F(\lambda) - F(\infty)]$ be of bounded variation together with the first n+1 derivatives; let $F_{(1)}^{(n+1)}$ be bounded, let the other derivatives be continuous. Then

$$\frac{dI(\varrho)}{d\varrho} = -\frac{F(0)}{\varrho^2} - \ldots - (2m+1)C_{2m} \frac{F^{(2m)}(0)}{\varrho^{2m+2}} + \frac{1}{\varrho^{n+1}} \varepsilon(\varrho).$$

There is 1 English reference.

ASSOCIATION: Moskovskiy gosudarstvennyy universitet imeni M.V.Lomonosova (Moscow State University imeni M.V.Lomonosov)

SUBMITTED: January 24, 1959

16(1) SOV/20-126-1-6/62

AUTHORS: Tikhonov, A.N., Corresponding Member, Academy of Sciences, USSR, Samarskiy, A.A.

TITLE: Asymptotic Expansion of Integrals With Slowly Decreasing Kernel (Asimptoticheskoye razlozheniye integralov s medlenno ubyvayushchim yadrom)

PERIODICAL: Doklady Akademii nauk SSSR, 1959, Vol 126, Nr 1, pp 26 - 29 (USSR)

ABSTRACT: Let h be a small positive parameter ; $a < x_0 < b$;

$$\omega(\xi) = \sum_{k=1}^{n} \frac{q_k^+}{\xi^k} + \omega_n^+(\xi) , \quad \omega_n^+(\xi) = O\left(\frac{1}{\xi^{n+1}}\right) \text{ for } \xi \to +\infty ;$$

$$\omega(\xi) = \sum_{k=1}^{n} \frac{q_k^-}{\xi^k} + \omega_n^-(\xi) , \quad \omega_n^-(\xi) = O\left(\frac{1}{\xi^{n+1}}\right) \text{ for } \xi \to -\infty .$$

Let the boundary values $q_1^+ = \lim\limits_{\xi \to \infty} \xi\omega(\xi)$ and $q_1^- = \lim\limits_{\xi \to -\infty} \xi\omega(\xi)$

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Asymptotic Expansion of Integrals With Slowly Decreasing Kernel

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be different in general.
Fundamental theorem: For $h \to 0$ the integral

$$I\left[h\ ;\ x_0\ ;\ f\right] = \frac{1}{h}\int_a^b \omega\left(\frac{x-x_0}{h}\right) f(x)dx$$

has the asymptotic expansion

$$I = \sum_{k=0}^{n} (\hat{I}_k \ln h + I_k)h^k + h^n \varrho(h) \quad , \quad \varrho(h) \to 0 \quad \text{for} \quad h \to 0 \ ,$$

if the following conditions are satisfied :
1.) $f(x)$ is bounded on (a,b) and has a differential of order $(n + 1)$ in x_0 .
2.) $\omega(\xi)$ is absolutely integrable on every finite interval.
The following denotations are used :

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SOV/20-126-1-6/62

Asymptotic Expansion of Integrals With Slowly Decreasing Kernel

$$\hat{I}_k = -\left(q^+_{k+1} - q^-_{k+1}\right)\frac{f^{(k)}(x_0)}{k\,!}$$

$$I_k = \left[C_k + q^+_{k+1}\ln(b - x_0) - q^-_{k+1}\ln(x_0 - a)\right]\frac{f^{(k)}(x_0)}{k\,!} +$$

$$+ q^+_{k+1}\int_{x_0}^{b}\frac{f_k(x)dx}{(x-x_0)^{k+1}} + q^-_{k+1}\int_{a}^{x_0}\frac{f_k(x)dx}{(x-x_0)^{k+1}} -$$

$$-\sum_{s=0}^{k-1}\frac{f^{(s)}(x_0)}{s\,!(k-s)}\left[\frac{q^+_{k+1}}{(b-x_0)^{k-s}} - \frac{q^-_{k+1}}{(x_0-a)^{k-1}}\right]$$

$$C_k = \int_{-1}^{+1}\Omega_k(\xi)d\xi + \int_1^{\infty}\left[\bar{\bar{\Omega}}^+_1(\xi) + \bar{\bar{\Omega}}^-_k(-\xi)\right]d\xi;$$

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Asymptotic Expansion of Integrals With Slowly Decreasing Kernel SOV/20-126-1-6/62

$f^{(k)}(x_0)$ is the k-th derivative in the point x_0 ; $f_k(x)$ is the remainder term of the Taylor series ;

$$\Omega_k(\xi) = \begin{cases} \xi^k \omega_k^+(\xi) & \text{for} \quad \xi > 0 \\ \xi^k \omega_k^-(\xi) & \text{for} \quad \xi < 0 \end{cases}$$

$$\overline{\Omega}_k(\xi) = \xi^k \omega_{k+1}(\xi)$$

ASSOCIATION: Moskovskiy gosudarstvennyy universitet imeni M.V.Lomonosova (Moscow State University imeni M.V. Lomonosov)

SUBMITTED: February 28, 1959

Card 4/4

24 (3), 24 (4) SOV/20-126-5-15/69

AUTHOR: Tikhonov, A. N., Corresponding Member, AS USSR

TITLE: On the Propagation of a Variable Electromagnetic Field in an Anisotropic Medium Consisting of Several Layers (O rasprostranenii peremennogo elektromagnitnogo polya v sloistoy anizotropnoy srede)

PERIODICAL: Doklady Akademii nauk SSSR, 1959, Vol 126, Nr 5, pp 967 - 970 (USSR)

ABSTRACT: The author of this article made attempts to calculate the electromagnetic field on the surface of an anisotropic, conductive medium $z \leqslant 0$. The following conditions should be complied with: The field is produced by a circuit whose current distribution in $z = 0$ is known. Without limiting the general nature of the problem, it may be assumed that the circuit is represented by an elementary dipole. The field in the half-space $z > 0$ is assumed to be quasi-stationary, and in $z < 0$ the displacement currents are assumed to be negligible. The afore-mentioned anisotropic, conductive medium is such that $\sigma_z = \sigma_3 \neq \sigma_1$ and $\sigma_x = \sigma_y = \sigma_1$; $\sigma_1(z) > 0$ and $\sigma_3(z) > 0$. Under these conditions, the

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On the Propagation of a Variable Electromagnetic Field in an Anisotropic Medium Consisting of Several Layers

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problem consists in the integration of the Maxwell equations. The tangential components of the field are assumed to be continuous at the surface of discontinuity $\sigma(z)$. For isotropic media, similar problems were already dealt with by Sommerfeld, Fok, and Stefanesku. If $\vec{E} = \text{grad}\,\Phi + \frac{i\omega\mu}{c}\vec{A}$, the condition of the "stratified" anisotropy is written: $\Phi = \frac{c}{4\pi}\left[\frac{1}{\sigma_3}\left(\frac{\partial A_x}{\partial x} + \frac{\partial A_y}{\partial y}\right) + \frac{1}{\sigma_1}\frac{\partial A_z}{\partial z}\right]$. After several transformations, the half-space $z > 0$ (for air) and $z < 0$ is then discussed, some special cases are investigated, and explicit formulas are written down for H_z, $\vec{E}$ and E_x. There are 2 Soviet references.

ASSOCIATION: Moskovskiy gosudarstvennyy universitet im. M. V. Lomonosova (Moscow State University imeni M. V. Lomonosov)

SUBMITTED: April 3, 1959

Card 2/2

25863

S/044/62/000/002/056/092
C111/C444

16.3900

AUTHORS: Tikhonov, A. N., Samarskiy, A. A.

TITLE: On the best schemes of differences

PERIODICAL: Referativnyy zhurnal, Matematika, no. 2, 1962, 31 abstract 2V171. ("Tr. Vses. soveshchaniya po different-sial'n. uravneniyam, 1958". Yerevan. AN Arm SSR, 1960, 167-178)

TEXT: One constructs the equation of differences which in a certain sense is the best one in order to approximate the differential equation

$$\frac{d}{dx}\left(k(x)\frac{du}{dx}\right) - q(x)\,u + f(x) = 0 \qquad (1)$$

with piecewise continuous coefficients. If on the intervals of continuity the functions q and f are twice, and k is three times continuously differentiable, and if the coefficients of the equation of differences are functionals of k, q, f, satisfying certain natural restrictions, then the constructed equation of differences has the second order of exactness, i. e. its solution is different by $O(h^2)$, where h is the lattice step, from the solution of the boundary value

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On the best schemes of differences C111/C444

problem (1). It is shown that the equation of differences which satisfies all the proposed demands and possesses the second order of exactness, is uniquely determined. Proofs are not given. A great deal of the results had been formerly published by the authors. (RZh Mat, 1960, 4570, 14419).

[Abstracter's note: Complete translation.]

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69499

16.6500, 16.3900, 16.3400 S/020/60/131/04/13/073

AUTHORS: Tikhonov, A.N., Corresponding Member AS USSR, and Samarskiy, A.A.

TITLE: Standard Homogeneous Difference Circuits

PERIODICAL: Doklady Akademii nauk SSSR, 1960, Vol.131, No.4, pp.761-764.

TEXT: The present paper is a continuation and a partial generalization of the earlier investigations of the authors (Ref.1-4). The authors consider homogeneous three-point-difference schemes for the solution of the boundary value problem

$$(1) \qquad L^{(k,q,f)}u = \frac{d}{dx}\left[k(x)\frac{du}{dx}\right] - q(x)u + f(x) = 0, \qquad 0 < x < 1$$

$$u(0) = \mu_1 \qquad u(1) = \mu_2.$$

The coefficients of the schemes are determined by certain nonlinear functionals, where the class of the admitted functionals is greater than in (Ref.3,2), so that the difference schemes are more general. If the functionals especially do not depend on the step h, then the scheme is called canonical (standard circuit). The authors investigate the order of exactness of the proposed schemes as well as of the error which appears

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Standard Homogeneous Difference Circuits S/020/60/131/04/13/073

during the solution of a single boundary value problem.
There are 4 Soviet references.

SUBMITTED: December 31, 1959

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16.3400

80076

S/020/60/131/06/010/071

AUTHORS: Tikhonov, A. N., Corresponding Member of the Academy of Sciences USSR, and Samarskiy, A. A.

TITLE: Coefficient Stability of Difference Circuits

PERIODICAL: Doklady Adademii nauk SSSR, 1960, Vol. 131, No. 6, pp. 1264-1267

TEXT: Let the boundary value problem

(1) $$L^{(p,q,f)}u = \frac{d}{dx}\left[\frac{1}{p(x)}\frac{du}{dx}\right] - q(x)u + f(x) = 0, \quad 0<x<1$$

$$u(0) = \mu_1, \quad u(1) = \mu_2,$$

be considered, the coefficients of which are piecewise continuous and bounded. Let $s_N = \{x_0 = 0, x_1 = h, \ldots, x_i = ih, \ldots, x_N = Nh = 1\}$ and

(3) $$L_h^{(p,q,f)} = \frac{1}{h^2}\left[(y_{i+1} - y_i)/B_i^h - (y_i - y_{i-1})/A_i^h\right] - D_i^h y_i + F_i^h.$$

$$A_i^h = A^h[\bar{p}_i(s)], \quad B_i^h = B^h[\bar{p}_i(s)], \quad -1 < s < 1, \quad \bar{p}_i(s) = p(x_i + sh).$$

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Coefficient Stability of Difference Circuits

$$D_i^h = D^h[q(x_i+sh)], \quad F_i^h = F^h[f(x_i+sh)], \quad -0.5 < s < 0.5 .$$

The functionals A^h, B^h, D^h, F^h are assumed to satisfy the assumptions A_1, A_2, A_3 from (Ref.1), the D^h, F^h to be linear.
L_h is called conservative if $B_i^h = A_{i+1}^h$.
Let y_i and $\tilde{y}_i$ be solutions of the problems

(8) $L_h^{(p,q,f)} y_i = 0, \quad 0 < i < N, \quad y_0 = \mu_1, \quad y_N = \mu_2$

and $\tilde{L}_h^{(p,q,f)} \tilde{y}_i = 0, \quad \tilde{y}_0 = \mu_1, \quad \tilde{y}_N = \mu_2,$

where

(9) $\tilde{L}_h^{(p,q,f)} \tilde{y}_i = h^{-2}(\Delta y_i / \tilde{B}_i^h - \nabla y_i / \tilde{A}_i^h) - \tilde{D}_i^h y_i - \tilde{F}_i^h$

(3) is called stable in coefficients, if from

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Coefficient Stability of Difference Circuits

$$\sum_{i=1}^{N-1} |\tilde{A}_i^h - A_i^h| h = \rho(h), \quad \sum_{i=1}^{N-1} |\tilde{B}_i^h - B_i^h| h = \rho(h)$$

(10)

$$\sum_{i=1}^{N-1} |\tilde{D}_i^h - D_i^h| h = \rho(h), \quad \sum_{i=1}^{N-1} |\tilde{F}_i^h - F_i^h| h = \rho(h)$$

where $\rho(h) \to 0$ for $h \to 0$ it follows

(11) $$|\tilde{y}_i - u(x_i)| \leq \rho_0(h) \longrightarrow 0 \quad \text{for } h \to 0$$

($u(x)$ is solution of (1)).
It is shown (theorem 4) that it is necessary and sufficient for the stability in coefficients of (3) that (3) is conservative.

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Coefficient Stability of Difference Circuits

The authors give 7 theorems and 2 lemmata.
There are 4 Soviet references.

SUBMITTED: December 31, 1959

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Card 4/4

TIKHONOV, A. N. and VASILYEVA, A. B. and VOLOSOV, V. M.

"Differential equations containing a small parameter."

Paper presented at the Intl. Symposium on Nonlinear Vibrations, Kiev, USSR, 9-19 Sep 61

Moscow State University, Moscow

APPROVED FOR RELEASE: 07/16/2001 CIA-RDP86-00513R001755610020-4"

16.3900

39405

S/044/62/000/006/075/127
B168/B112

AUTHORS: Tikhonov, A. N., Samarskiy, A. A.

TITLE: Uniform difference schemes

PERIODICAL: Referativnyy zhurnal. Matematika, no. 6, 1962, 24-25, abstract 6V131 (Zh. vychisl. matem. i matem. fiz., v. 1, no. 1, 1961, 5-63)

TEXT: Results obtained by the authors and published from 1956 to 1960 (RZhMat, 1959, 9482 and 10155; 1960, 3453, 4570, 12120, 14419; 1961, 1V244, 1V245, 10V221) are analyzed with substantial revisions. Uniform schemes are studied for the solution of the first boundary value problem

$$L^{(k,q,f)}u = \frac{d}{dx}\left[k(x)\frac{du}{dx}\right] - q(x)u + f(x) = 0 \quad (0 < x < 1) \qquad (1)$$

$$u(0) = \overline{u_1}, \quad u(1) = \overline{u_2},$$

where the coefficients k, q, f are piecewise continuous functions $(k, q, f \in Q^{(0)})$ with $k(x) \geqslant M > 0$ and $q(x) \geqslant 0$. The characteristic of the

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family of difference schemes for differential equation (1) in class $Q^{(0)}$ of piecewise continuous coefficients is given in §1. The authors examine the three-point uniform difference schemes $L_h^{(k,q,f)}$, which are characterized by the linear generating function

$$\phi^h\left[\bar{u}(m),\ \bar{k}(s),\ \bar{q}(s),\ \bar{f}(s)\right] = \frac{1}{h^2}\left[B^{(h,\bar{k})}(\bar{u}_1-\bar{u}_0) - A^{(h,\bar{k})}(\bar{u}_0-\bar{u}_{-1})\right] - D^{(h,\bar{q})}\bar{u}_0 + F^{(h,\bar{f})},$$

where each of the coefficients is a functional of only one coefficient of equation (1):

$$A^{(h,\bar{k})} = A^h\left[\bar{k}(s)\right],\quad B^{(h,\bar{k})} = B^h\left[\bar{k}(s)\right] \quad (-1 \leqslant s \leqslant 1),$$

$$D^{(h,\bar{q})} = D^h\left[\bar{q}(s)\right],\quad F^{(h,\bar{f})} = F^h\left[\bar{f}(s)\right].$$

D^h and F^h are linear functionals. The error in the approximation of the

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scheme

$$\varphi(\bar{x},u,h) = (L_h^{(k,q,f)}u)_{x=\bar{x}} - (L^{(k,q,f)}u)_{x=\bar{x}},$$

where $q(x)$ is the solution of equation (1), is investigated. For this purpose the function $\varphi(\bar{x},u,h)$ is expanded with regard to the parameter h and the coefficients at the powers of h are calculated up to the r-th order. This is possible on the assumption that the master functionals A^h, B^h, D^h, F^h have derivatives of the corresponding orders both for the parameter h and for their own functional argument. A determination of the rank of the functional, including requirements for differentiability, uniformity, monotonicity, and normalization, is carried out. Proceeding from the concept of rank of the functional, the authors study different classes $\mathcal{L}(n_1, n_2, n_3)$ of schemes in which the functionals A^h and B^h have the rank n_1, D^h and F^h the ranks n_2 and n_3, respectively, and are determined on the interval $-0.5 \leqslant s \leqslant 0.5$. Special families of schemes - conservative, discrete, and canonical - are examined. The necessary and sufficient conditions of the n^{th} order of approximation of the scheme

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$L_h^{(k,q,f)}$ (n = 1.2) from class $\mathcal{L}(n+1, n, n)$ are given in the form of a series of correlations for the moments of the master functionals. Problems associated with the convergence and accuracy of the uniform difference schemes in the class of smooth coefficients $C^{(m)}$ are studied in §2. Using the apparatus of Green's difference function for the operator $L_h^{(k,q)}$ the authors demonstrate that a necessary and sufficient condition is the n^{th} order of approximation if the scheme $L_h^{(k,q,f)}$ from class $\mathcal{L}(n+1,n,n)$ for $k(x) \in C^{(m_k)}$, $m_k \geq n+1$, $q(x) \in C^{(m_q)}$, $m_q \geq n$, $f(x) \in C^{(m_f)}$, $m_f \geq n$ is to have the n^{th} order of accuracy. Uniform lower and upper bounds are given for Green's difference function. In the study of the convergence and accuracy in the class of smooth coefficients the norm $\|\psi\| = \max_{0 \leq i \leq n} |\psi_i|$, and in the class of discontinuous coefficients the norms $\|\psi\|_3 = \sum_{i=1}^{N-1} |\psi_i| h$ and

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$\|\psi\|_2 = \sum_{i=1}^{N-1} h \left| \sum_{s=1}^{i} \psi_s h \right|$ are used. The order of accuracy and that of approximation of the scheme $L_h^{(k,q,f)}$ in class $C^{(m)}$ coincide, but in the cl class of discontinuous coefficients, as is shown by an example, this is not so. The error of approximation φ_n^h and φ_{n+1}^h where $x = x_n$, $x = x_{n+1}$, i.e. at net points adjacent to the point of discontinuity ξ $(x_n \leqslant \xi \leqslant x_{n+1})$ of the coefficient $k(x)$, tends to infinity for $h \to 0$. However, in §3 it is shown that the solution of the difference equation will converge to the solution of equation (1) if the scheme $L_h^{(k,q,f)}$ in class $Q^{(m)}$ satisfies the necessary condition

$$\Delta(\xi,h) = h(B_n^h \varphi_{n+1}^h + A_{n+1}^h \varphi_n^h) = Q(h) \to 0 \qquad (2)$$

or

$$\frac{B_n^h B_{n+1}^h}{k_n} - \frac{A_n^h A_{n+1}^h}{k_1} = Q(h) \to 0 \text{ for } h \to 0, \qquad (2')$$

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Uniform difference schemes

where $k_1 = k(\xi - 0)$, $k_n = k(\xi + 0)$. If the scheme $L_h^{(k,q,f)}$ in $Q^{(m)}$ is to have the 2nd order of accuracy, the following conditions must be fulfilled:

$$h^2\varphi_n^h = O(h^2),\ h^2\varphi_{n+1}^h = O(h^2),\ \Delta(\xi,h) = O(h^2).$$

Any conservative scheme of zero rank satisfies the necessary condition of convergence. For a scheme of type $\mathcal{L}(1, 0, 0)$ condition (2) is a sufficient condition of convergence in the class of coefficients $k(x) \in Q^{(1)}$, q, $f \in Q^{(0)}$. In §4 a norm of perturbation of the coefficients of the scheme is introduced and a definition of coefficient stability of the difference scheme is given. With a small distortion of the coefficients of the scheme the "perturbed" scheme must converge when $h \to 0$ in $Q^{(m)}$, i.e. $\|\tilde{y} - u\|_1 = \varrho(h) \to 0$ when $h \to 0$ if $\|\tilde{A}^h - A^h\|_3 = \sum_{i=1}^{N-1} |\tilde{A}_i^h - A_i^h| h = \varrho(h)$, $\|\tilde{B}^h - B^h\|_3 = \varrho(h)$, $\|\tilde{D}^h - D^h\|_3 = \varrho(h)$, $\|\tilde{F}^h - F^h\|_3 = \varrho(h)$, (all values of

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$\varrho(h) \to 0$ when $h \to 0$), where $\tilde{y}_i$ is the solution of the difference boundary value problem with disturbed coefficients $\tilde{A}_i^h$, $\tilde{B}_i^h$, $\tilde{D}_i^h$, $\tilde{F}_i^h$, and $u(x)$ is the solution of problem (1). Its conservativeness is a necessary and sufficient condition for the coefficient stability of the canonical scheme. Questions relating to the convergence and accuracy of the conservative difference schemes are studied in §5. It is demonstrated that the zero-rank conservative scheme converges in the class of piecewise continuous coefficients (k, q, $f \in Q^{(0)}$); any conservative scheme of the first rank has the first order of accuracy in the class of coefficients $Q^{(m)}$ ($m \geqslant 1$); any conservative scheme of the second rank which satisfies the conditions of the second order of approximation has the second order of accuracy in class $C^{(2)}$, but in class $Q^{(m)}$ ($m \geqslant 1$) the first. These theorems are proved by means of an a priori estimate $\|z\|_1 \leqslant M\|\varphi\|_2$, where z is the error in the solution of the difference boundary value problem, and φ is the error in approximation of the scheme $L_h^{(k,q,f)}$ in the solution

of problem (1). By estimating the error of approximation φ from the norm $\| \|_2$ it is possible to reduce the rank of the master functionals and the order m of the classes $C^{(m)}$ or $Q^{(m)}$ of the coefficients of equation (1). [Abstracter's note: Complete translation.]

TIKHONOV, A.N.; SHAKHSUVAROV, D.N.

Asymptotic irregularities of electromagnetic fields induced by an alternating current dipole in layered media. Izv. AN SSSR. Ser. geofiz. no.1:107-110 Ja '61. (MIRA 14:1)

1. Akademiya nauk SSSR, Institut fiziki Zemli.
(Electromagnetic prospecting)

TIKHONOV, A.N. (Moskva); SAMARSKIY, A.A. (Moskva)

Uniform difference systems of a high order of accuracy on nonuniform nets. Zhur. vych. mat. i mat. fiz. 1 no.3:425-440 My-Je '61. (MIRA 14:8)

(Difference equations)

30735
S/208/61/001/005/003/007
A060/A126

16.3900 16.6500

AUTHORS: Tikhonov, A. N., Samarskiy, A. A. (Moscow)

TITLE: The Sturm-Liouville finite difference problem

PERIODICAL: Zhurnal vychislitel'noy matematiki i matematicheskoy fiziki, v. 1, no. 5, 1961, 784 - 805

TEXT: This is a continuation of the work on homogeneous difference schemes reported by the authors in the same journal (v. 1, no. 1, 1961, 5 - 63). The solution of the Sturm-Liouville problem for the equation

$$L^{(k,q)}u + \lambda r(x)u = 0, \ 0 < x < 1, \quad L^{(k,q)}u = \frac{d}{dx}\left[k(x)\frac{du}{dx}\right] - q(x)u(x) \qquad (1)$$

+

by the method of finite differences has been treated by a number of authors. They treated problems of precision and convergence in the class of smooth coefficients for difference schemes of the partial type. Subject work treats difference schemes studied in the above contribution, for the solution of the Sturm-Liouville problem in the class of discontinuous coefficients $Q^{(m)}$. The formulation of the problem, the characteristics of the original family of difference schemes, and the proof of

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The Sturm-Liouville finite difference problem

the convergence of the finite difference method are presented. With the aid of an a-priori estimate the order of precision for $Q^{(m,1)}$ for the solution of the finite difference problem at $h \to 0$ is established. It is proved that the difference scheme

$$L_h^{(k,q,\lambda r)} y = (a y_{\bar{x}})_x - dy + \lambda \rho y,$$

where

$$a = \left[\int_{-1}^{0} \frac{ds}{k(x+sh)} \right]^{-1}, \quad d = \int_{-0.5}^{0.5} q(x+sh)ds, \quad \rho = \int_{-0.5}^{0.5} r(x+sh)ds,$$

ensures precision of the second order for the class of discontinuous coefficients. In the continuations to follow the authors promise to treat homogeneous finite difference schemes yielding arbitrary orders of precision in the class of piece-by-piece continuous coefficients of equation (1), as well as the problem of precision on non-uniform grids. There are 5 references: 2 Soviet-bloc and 3 non-Soviet-bloc.

SUBMITTED: May 14, 1961

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X

TIKHONOV, A.N.; LIPSKAYA, N.V.; DENISKIN, N.A.; NIKIFOROVA, N.N.; LOMAKINA, Z.D.

Electromagnetic sounding of deep layers of the earth. Dokl. AN SSSR 140 no.3:587-590 S '61. (MIRA 14:9)

1. Institut fiziki Zemli im. O. Yu.Shmidta AN SSSR; 2. Chlen-krooespondent AN SSSR (for Tikhonov).
(Magnetism, Terrestrial)

TIKHONOV, A.N.; LOMAKINA, Z.D.; SHAKHSUVAROV, D.N.

[Tables of impedances for stratified space in the field of a plane electromagnetic wave] Tablitsy impedansov dlia sloistogo prostranstva v pole ploskoi elektromagnitnoi volny. Moskva, Izd-vo Mosk. univ., 1962. 48 p. (MIRA 16:3)

(Electromagnetic waves)

(Geophysics—Tables, calculations, etc.)

TIKHONOV, A.N. (Moskva); GORBUNOV, A.D. (Moskva)

Asymptotic error expansion in the difference method for solving Cauchy's problem for a system of ordinary differential equations. Zhur.vych.mat.i mat.fiz. 2 no.4:537-548 Jl-Ag '62. (MIRA 15:8)
(Errors, Theory of) (Differential equations)

TIKHONOV, A. N. (Moskva); GORBUNOV, A. D. (Moskva)

Optimality of implicit difference systems of the Adams type.
Zhur. vych. mat. i mat. fiz. 2 no.5:930-933 S-O '62.
(MIRA 16:1)

(Differential equations)